RESTORED

PATENT SPECIFICATION

735,105

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COMPLETE SPECIFICATION

Improvements in or relating to Electric Arc Stud Welding or Soldering Guns

We, SVENSKA AKTIEBOLAGET GASACCUMULATOR, of Lidingo, Stockhólm, Sweden, a Swedish Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to electric arc stud welding or soldering guns, and is particularly concerned with improvements in such guns of the kind including arc-length regulating means whereby the predetermined length of arc may be accurately maintained independent of variations, within limits, in the length of the object to be welded or soldered, said means comprising mutually displaceable units one of which carries the stud or the like to be welded or soldered to the workpiece, while the other unit is displaceable by electromagnetic action of a solenoid through a predetermined distance, and means operating, on electromagnetic displacement of the latter unit, for interlocking the units so that the electromagnetically displaced unit carries the other unit with it through said predetermined distance for forming the arc, said interlocking means permitting free relative displacement of the said units in the opposite direction. In such arc-length regulating means the units, when interlocked, are displaced by the action of the solenoid to withdraw said object from the workpiece to said predetermined distance for forming the arc.

The present invention has for its object to provide an improved, simple and effective construction of electric arc stud welding or soldering gun of the kind referred to.

According to the present invention, in an electric arc stud welding or soldering gun of the kind referred to, interlocking of the said mutually displaceable units is effected by a clutch device constituting, or provided on, the electromagnetically displaceable unit and consisting of or comprising a pivotal part or parts adapted under the direct influence of magnetic force to engage and interlock with the other unit.

Conveniently, a solenoid disposed in the gun is adapted to actuate the pivotal part or parts for interlocking the displaceable units and also to effect displacement of the interlocking units in one direction.

The said clutch device may comprise a pair of pivoted parts having substantially conical outer surfaces adapted, under the influence of magnetic force, to engage and lock with the inner surface of a cylindrical tube forming part of the relatively displaceable unit. The said clutch device extends centrally in the solenoid into proximity to an iron core disposed in the solenoid. The said clutch device may comprise a pair of lever members which are mutually pivotable on an axis at right angles to the said tube. A spring may be disposed within the said tube to press the clutch device towards the iron core of the solenoid. A pin disposed in the iron core may extend a short distance outside thereof to form a stop for the said clutch device, the said pin being displaceable into the core against the action of a spring.

In a preferred form the said clutch device is provided with at least one end surface facing towards the solenoid and inclined in relation to the direction of displacement of the said device, in which case the iron core may be provided with an end surface or surfaces facing towards the clutch device and substantially parallel with the inclined end surface or surfaces thereof.

For adjusting the initial relative positions of the displaceable units, a sleeve for supporting the gun upon or against a

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workpiece is removably attached to the gun housing and is adapted for axial adjustment in relation thereto.

The improved electric arc stud welding or soldering gun may be used in conjunction with a soldering medium, in a manner disclosed in Patents Nos. 681,585 and 681,586, for connecting studs or the like to a workpiece by soldering.

The invention is hereinafter described, by way of example, with reference to the accompanying diagrammatic drawings, in which:—

Fig. 1 is a longitudinal section showing a welding or soldering gun provided with the improved arc-length regulating means according to the invention: and

Fig. 2 is a detailed longitudinal section illustrating a modification.

In carrying the invention into effect according to one embodiment, and as shown in Fig. 1, the housing 1 of a welding or soldering gun is, except for the handle 2, of circular cross-section throughout its entire length. One end section 3 of the housing is adapted to form part of a collet chuck 3*a* provided with a nut 4. A sleeve 5, which tapers off towards its outer end and is provided with a replaceable porcelain collar 6 for supporting the gun upon or against a workpiece, extends through the collet chuck 3*a* and may be held by the collet chuck in any desired position of axial displacement.

An insulating body 7 is fixed in the housing and a rod 8 extends through the body 7, said rod at its outer end carrying a chuck 9 in which an object such as a stud 10 to be attached to a workpiece by welding or soldering is secured.

The inner end of the rod 8 carries an extension member 11 having a tube 12 secured therein and extending towards and partly into a solenoid 13. A helical spring 43 is disposed around the extension member 11 and the tube 12 and abuts at one end against a support 14 within the housing, and at its other end against a flange 15 of the extension member 11 whereby the latter is pressed against a member on the insulating body 7. The tube 12 accommodates a clutch device comprising a pair of levers 16 having conical outer surfaces and made of iron or other magnetic material each having a part 18 extending therefrom, and a pivot 17 at right angles to the tube 12 on which the levers 16 are mutually pivotable. The levers 16 may be formed from a body comprising a cylindrical portion corresponding to the parts 18 and a slightly conical portion at the base of which a transverse bore is provided for the pivot 17, the body being cut lengthwise into two parts. The clutch device is free to slide within the tube 12 and a shoe 19 presses against the parts 18 under the action of a spring 20 which tends to push the clutch device out of the tube 12. The levers 16 are provided with end surfaces 21 which are inclined in relation to the path of displacement, i.e., the longitudinal axis of the tube 12, and are adapted to co-operate with correspondingly inclined surfaces 22 of an iron core 23 inserted in the outer end of the solenoid 13. A pin 24 disposed centrally in the iron core 23 extends somewhat beyond the adjacent portions of the surfaces 22 and is pressed outwards by a spring 26 disposed between the pin 24 and a screw plug 27. A flange 25 on the pin serves to limit the outward displacement thereof.

The tube 12, extension member 11, rod 8 and chuck 9 constitute a displaceable unit, while the clutch device comprising the levers 16 and pivot 17 constitutes another displaceable unit.

The operation of the improved arc-length regulating means is as follows:—

When it is desired to weld or solder a stud 10 to a workpiece, the stud is inserted into the chuck 9 and the sleeve 5 is fixed by means of the collet chuck 3*a* in a suitable extended position, so that the porcelain collar 6 will be a short distance inwards of the outer end surface of the stud 10, as shown in Fig. 1. The gun is held so as to place the stud 10 in the desired position on the workpiece and the porcelain collar 6 is advanced towards the work by the weight of the gun or by hand. Thus, the stud 10 is pushed into the gun until its outer end surface coincides with that of the porcelain collar. By this action the displaceable unit comprising the chuck 9, the axle 8, the extension 11 and the tube 12 is also pushed inwards, i.e., to the right in Fig. 1, and the spring 43 is correspondingly compressed. A space will thus be formed between the left hand end surface of the extension 11 in Fig. 1 and the adjacent part of the member on the insulating body 7.

The clutch device comprising the levers 16 is not displaced during the above displacement of the tube 12 but remains at rest against the extended pin 24, as shown in Fig. 1, owing to the fact that the pressure of the spring 26 exceeds that of the spring 20. Current is then applied to the solenoid 13 by the closing of a contact by means of a button 28 in the handle 2. Due to the disposition of the opposed inclined surfaces 21, 22, the magnetic force developed in the core 23 acts in directions substantially perpendicular to the inclined surfaces, i.e., with a radial and an axial component. The spring 26 opposes the axial component and consequently the magnetic force acts first to swing the levers

16 slightly outwards about the pivot 17. The external conical parts of the levers 16 consequently assume an external cylindrical form and are pressed and thereby locked against the inside of the tube 12, the spacing between the inclined surfaces 21, 22 being maintained by the spring 26 acting on the pin 24. The radial component being thus eliminated, continued influence of the magnetic force, now acting with the axial component only, overcomes the pressure of the spring 26 so that the clutch device is attracted by the iron core until the surfaces 21 and 22 abut. The pin 24 is thereby pushed into the core as the force of the spring 26 exceeds that of the spring 20 by an amount that is smaller than the magnetic force.

The displacement of the clutch device to the right, as shown in Fig. 1, is thus communicated to the tube 12 and, with it, to the extension 11, the rod 8, the chuck 9 and the stud 10. Since current is applied to the stud 10 at the same time as to the solenoid 13, an arc will form between the stud 10 and the workpiece and the outer end of the stud or solder thereon will melt. After a short interval the supply of current is interrupted and the magnetic force is cut off. The clutch device releases its hold on the tube 12 as soon as the magnetic force disappears, and the shoe 19 also may contribute to some extent to the separation of the parts 18 with consequent inward movement of the levers 16, whereby the latter disengage the tube 12 and the clutch device remains in abutting relation to the pin 24. The heavy spring 43 immediately displaces the extension 11 towards the insulating body 7 and this displacement in the outward direction relative to the gun is communicated to the rod 8, the chuck 9 and the stud 10. As a consequence, the melted outer end or solder of the stud is pressed against the workpiece and becomes firmly fixed to it when the molten pool formed round the end of the stud has solidified. The adjusting arrangement is then ready for the welding or soldering of a following stud.

It will be apparent that the clutch device comprising the levers 16 will interlock with the tube 12 in the manner described irrespective of the position of the device in the tube 12, and that it will always be attracted to move the same distance, this being the distance between the contact surfaces 21 and 22, as determined by the pin 24. Therefore, the stud 10 will always be lifted an equal distance away from the workpiece and the correct length of arc and the good quality of the welded or soldered joint accruing therefrom will be assured independently of the length of stud protruding beyond the porcelain collar prior to the application of the gun to the workpiece. This presupposes, of course, that there is sufficient room for the displacement of the clutch device in the tube 12.

The amount by which the stud is lifted away from the workpiece is thus determined by the length of the pin 24 and the position of the shoulder of the core 23 cooperating with the flange 25 and may easily be changed by replacing the pin 24. The shouldered portion of the iron core also may comprise a sleeve which is adjustable axially in the core and is accessible from the outside of the gun so as to make possible convenient adjustment of the axial position of the inclined surfaces 22.

In the modification illustrated in Fig. 2, a pivotal clutch device 31 has substantially the shape of a hook with a pair of opposite contact surfaces 32 and 33 adapted to have a cam action for locking the device to a tube 35. For example, one surface, such as the surface 32, may be slightly rounded so that, if the right hand end of the locking member swings upward, as viewed in Fig. 2, under the influence of the magnetic force from the iron core 34, the device 31 pivots on the surface 32 which rests on one elongated contact surface 36 of the tube 35, the end of the device 31 sliding over the pin 24. The other surface, 33, is eccentrically or otherwise suitably formed so as to lock with the other elongated contact surface 37 of the tube 35 during the swinging of the locking device. After locking is effected by the cam action of the device 31, the magnetic force overcomes the pressure of the spring 26 so that the device 31, carrying with it the tube 35, is drawn towards the core 34 until the inclined surfaces 21, 22 abut. The surfaces 36 and 37 need not form parts of a cylindrical surface. They may, for instance, comprise a pair of opposing plane walls of sufficient length disposed within the tube 35. The clutch device 31 therefore may have a variety of different shapes.

It will be understood that the invention is not limited to the particular embodiments hereinbefore described.

What we claim is:—

1. An electric arc stud welding or soldering gun of the kind referred to, wherein arc-length regulating means comprises mutually displaceable units one of which carries the object to be welded or soldered to a workpiece, while the other unit is displaceable by electromagnetic action of a solenoid through a predetermined distance, and means operating, on electromagnetic displacement of the latter unit, for interlocking the units so that the electromagnetically displaced unit carries

the other unit with it through said predetermined distance for forming the arc, said interlocking means permitting free relative displacement of the said units in the opposite direction, characterised in that interlocking of the said mutually displaceable units is effected by a clutch device constituting or provided on the electromagnetically displaceable unit and consisting of or comprising a pivotal part or parts adapted, under the direct influence of magnetic force, to engage and interlock with the other unit.

2. An electric arc stud welding or soldering gun according to Claim 1, wherein a solenoid disposed in the gun is adapted to actuate the pivotal part or parts for interlocking the displaceable units and also to effect displacement of the interlocking units in one direction.

3. An electric arc stud welding or soldering gun according to Claim 2, wherein the said clutch device comprises a pair of pivoted parts having substantially conical outer surfaces adapted, under the influence of magnetic force, to engage and lock with the inner surface of a cylindrical tube forming part of the relatively displaceable unit.

4. An electric arc stud welding or soldering gun according to Claim 3, wherein the said clutch device comprises a pair of lever members which are mutually pivotable on an axis at right angles to the said tube.

5. An electric arc stud welding or soldering gun according to Claim 4, wherein the said clutch device extends centrally in the solenoid into proximity to an iron core disposed in the solenoid.

6. An electric arc stud welding or soldering gun according to Claim 5, wherein a spring is disposed within the said tube to press the clutch device towards the iron core of the solenoid.

7. An electric arc stud welding or soldering gun according to Claim 5 or Claim 6, wherein a pin disposed in the iron core extends a short distance outside thereof to form a stop for the said clutch device, the said pin being displaceable into the core against the action of a spring.

8. An electric arc stud welding or soldering gun according to any of the preceding Claims 5 to 7, wherein the said clutch device is provided with at least one end surface facing towards the solenoid and inclined in relation to the direction of displacement of the said device and the iron core disposed in the solenoid is provided with an end surface or surfaces facing towards the clutch device and substantially parallel with the inclined end surface or surfaces thereof.

9. An electric arc stud welding or soldering gun according to any of the preceding claims, wherein a sleeve for supporting the gun upon or against a workpiece is removably attached to the gun housing and is adapted for axial adjustment in relation thereto, for the purpose described.

10. In or for an electric arc stud welding or soldering gun, the improved arc-length regulating means, substantially as hereinbefore described with reference to the accompanying diagrammatic drawings.

URQUHART-DYKES & LORD,
Chartered Patent Agents,
Maxwell House, 11, Arundel Street,
Strand, London, W.C.2.
and
12, South Parade, Leeds 1, Yorks.

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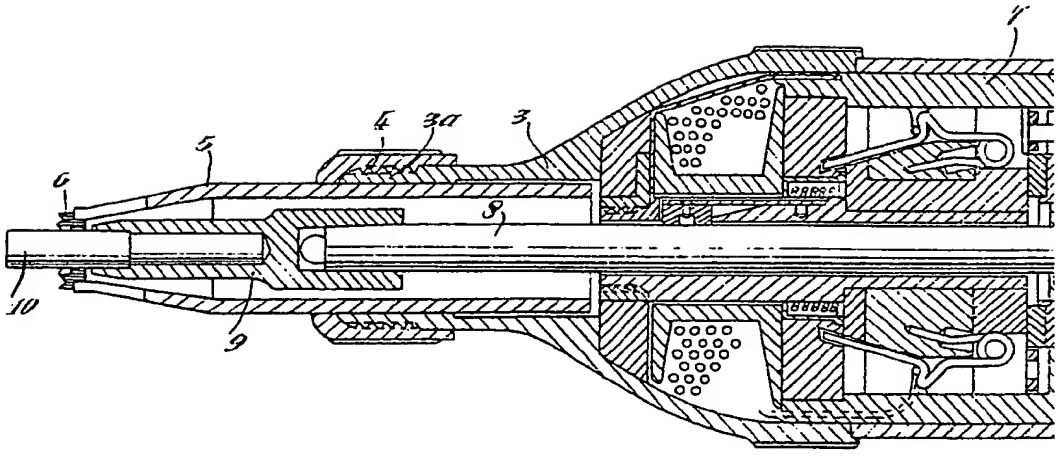

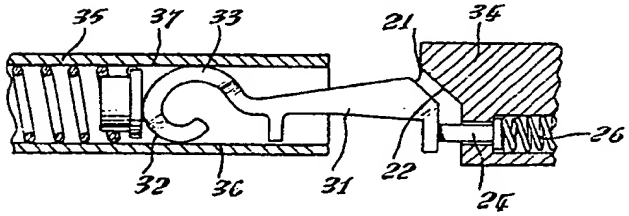

Fig. 2.

Fig

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1 SHEET

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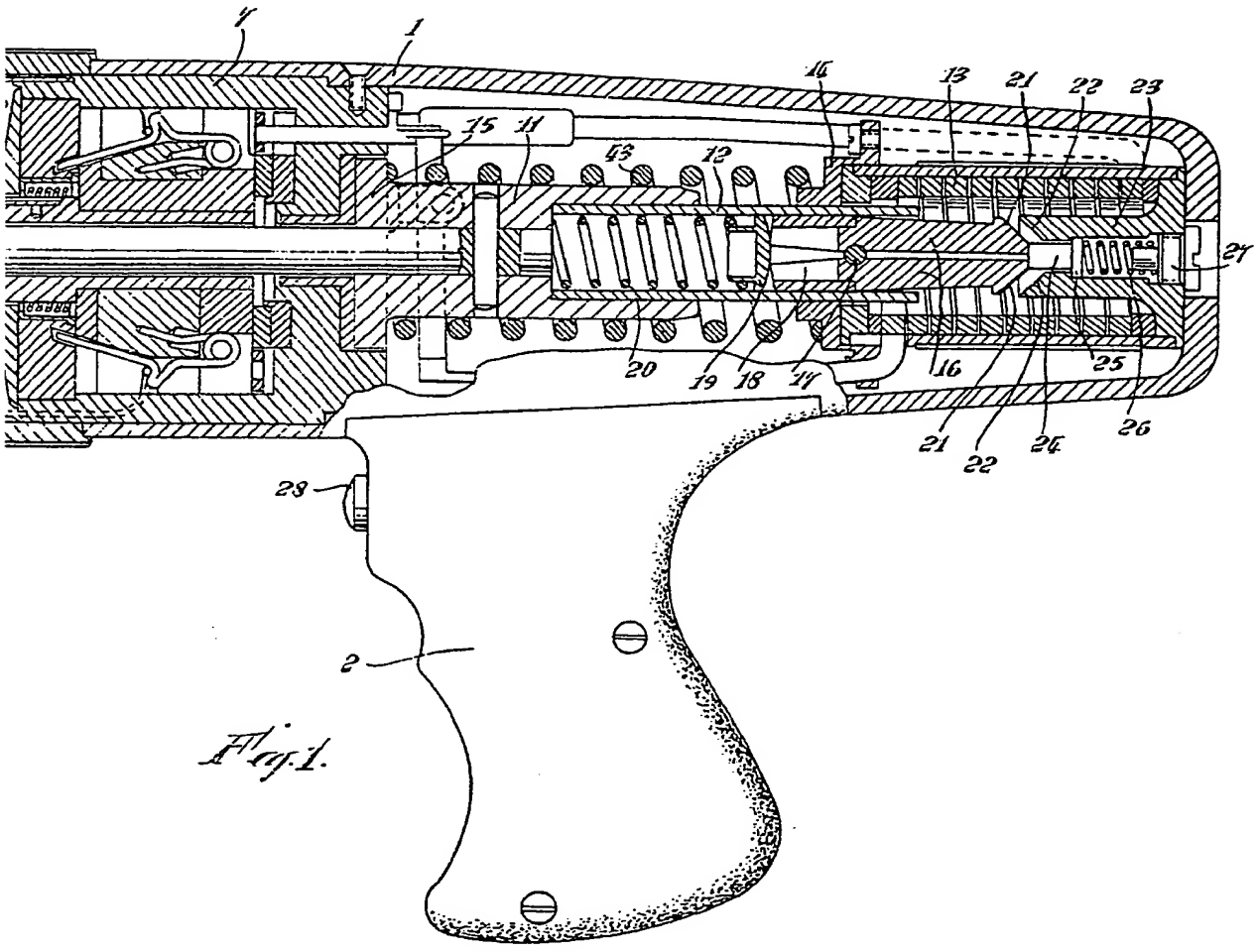

Fig. 1.

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1 SHEET

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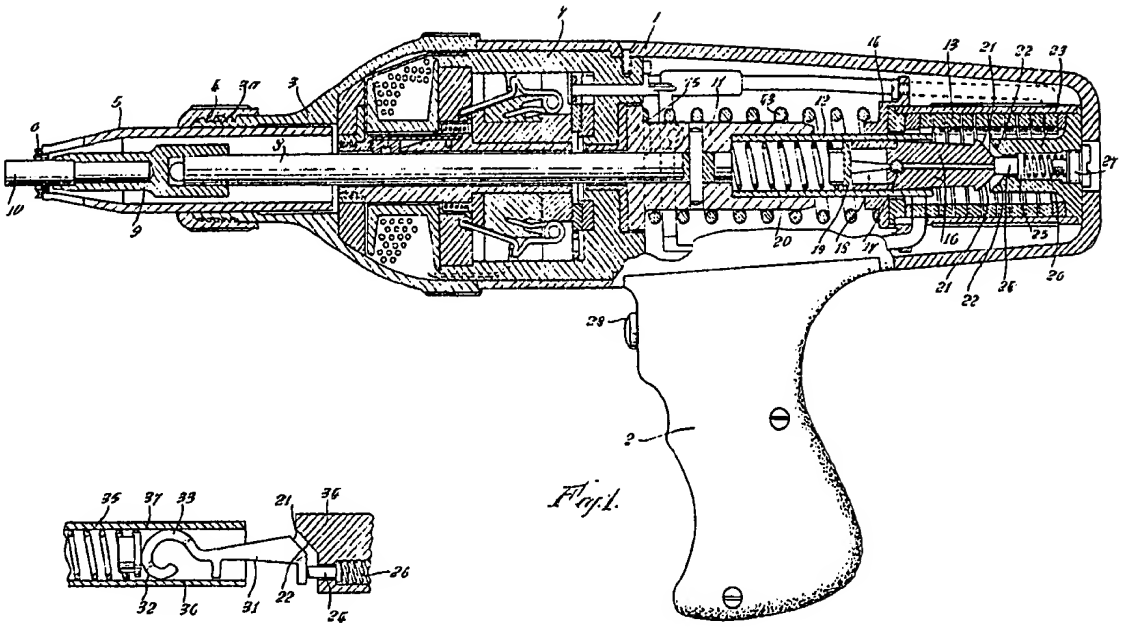

Fig. 1.

Fig. 2.